



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

AMERICAN STATISTICAL ASSOCIATION

NEW SERIES, No. 116.

DECEMBER, 1916.

A STUDY IN SOCIAL DYNAMICS: A STATISTICAL DETERMINATION OF THE RATE OF NATURAL INCREASE, AND OF THE FACTORS ACCOUNTING FOR THE INCREASE OF POPULATION IN THE UNITED STATES.

BY JOHN M. GILLETTE, PH.D., *Professor of Sociology, University of North
Dakota.*

Little appears to have been published relative to the specific points discussed in this study. The present writer has become interested in the field in consequence of the repeated attempts he has made to ascertain the amount of rural migration. In seeking to devise methods by which that factor could be measured, he has gradually developed conceptions as to how the larger problems of natural increase for the nation and its parts and how the factors which determine any particular kind of community increase may be measured. His earlier publications of estimates of rural migration unfortunately were inaccurate, but a later study* in this present field, which embraced a calculation of that factor also, laid a more ample and trustworthy foundation for the present investigation. In the same issue Mr. Earl Clark, of the Russell Sage Foundation, published an estimate of the factors of urban increase in the United States,† the results of which, when account is taken of the somewhat different view of the scope of the undertaking, practically agree with those embodied in the study just cited.

Investigations relative to natural increase of population in

*"Measure of Rural Migration and Other Factors of Urban Increase in the United States," by John M. Gillette and George R. Davies, *QUARTERLY PUBLICATIONS* of the American Statistical Association, Vol. XIV, pp. 640-653.

†"Contributions to Urban Growth," by Earl Clark, *Ibid.*, pp. 654-671.

the nation as a whole, in its several geographical divisions, and in its distinct types of communities, rural and urban, which further attempt to analyze the situation relative to those different areas and communities so as to exhibit the comparative strength of the various determining and contributing factors affecting the increase or decrease, are of the profoundest significance. They are far beyond being of "academic" interest only, for they reveal the mechanism of the national population at work and the basis for a causal interpretation in the field of economics, political science, sociology, history, ethics, and other related sciences. They throw light on and go far towards answering the question as to what stocks in our population, native or foreign born, are the vigorously reproductive ones. They yield data which will do much to determine whether or not immigration to this country has actually increased the population beyond what it would have been had the nation depended on its own reproductive powers alone. They also help to answer the query as to which kind of community, rural or urban, is the more advantageous with respect to the increase of population. In like manner they reflect the determinative influence which economic opportunities have on natural increase as exhibited in the varying rates of the different geographical divisions. Further, these results reveal unmistakable differences between native and foreign stocks, and the Negro and white races, in their competition for survival.

Such considerations and results invest the data with a practical concern of the utmost gravity. They project into the governmental sphere such questions as these: what stock, regions, and kind of community are most advantageous when measured by their effects on the fecundity of population? Since the results are what they are, what should the governments, national, state, and municipal, undertake to ward off the decadent tendencies and to place a premium on the beneficial ones?

They also project the same practical questions into the arena of individual consideration, and arouse serious personal concern. In view of the unfavorable conditions that must be inferred to exist in some regions or in some kinds of community,

should he seek to cast his lot in the region or community which is proven to be the more favorable to human life? The vast interdivisional migration of native born populations indicates that already millions of people are instinct with this consideration. Should other millions once become intelligent and acquainted with the actual conditions, a movement might result that would change the balance of population and affect the destiny of great areas.

The difficulties involved in making estimates in this field are great. Because of the almost overwhelming complexity of the situation, the multitudes of unknown factors involved, and the dearth of exact and pertinent data, the project is not dissimilar to that of the celestial physicist who, not being able to observe the disturbing body, is obliged to locate it by a long series of mathematical calculations.

The veteran statistician knows perfectly well that an investigation of this nature develops problem after problem for which there exists no ready made solution and which the ingenuity of the investigator must meet by devices and methods wrought out as occasion demands. The search for facts which will give a cue to the solution of such problems is time-consuming and frequently disappointing. Circuitous methods are often necessary which many times lead the zealous amateur worker into blind alleys. It may be glorious to spend a month of earnest effort to work out results by a newly invented device, but if they are worthless it is indeed discouraging. There is no glory unless success is at last attained. The writer has nearly 200 pages of legal notepaper filled with the mere indication of methods and results developed in the course of this investigation, and the mathematical operations to carry out the methods would demand a far greater space. It has often been a case of trial and error. Perhaps the reason the task has not been executed earlier was that the veteran statistician suspected the risks involved in the project and the foolhardiness of the undertaking.

The statistician does not expect absolute accuracy in a set of statistical results because he knows that statistics is the science of estimates and that the final figures are only approximations. The only claim that a statistical in-

vestigator dare make is that his conclusions come close to the true situation.

The writer has sought to work out scientific methods by means of which the problems set up might be solved. That there is such close conformity in several sets of results which were worked out by utterly different methods is the most convincing evidence to his mind that the conclusions are approximately correct. This is particularly true respecting the rates of natural increase attained for the United States. Those worked out by means of data and methods quite independent of each other show a divergence of only about five one hundredths of one per cent. And much the same is true of the division rates independently obtained, and of the totals of the factor, rural migration, resulting from several distinct operations.

I made certain modifications in mortality rates, as a concession to Professor Walter F. Willcox, after I read his strictures on low mortality rates reported by some of our western states.* I revised my estimates in several states for both rural and urban districts, raising them somewhat above my first estimate. Since the rates for these communities, for the different divisions, and for the nation are the weighted averages of the local rates, the final rate of natural increase for the nation was only slightly lowered.

No doubt the general scheme adopted here will undergo a modification in certain of its particulars in the hands of critical investigators. But the present undertaking should serve as a foundation and point of departure for future workers in the attainment of similar results. When the next census data are made available, it will be possible to apply the plan developed here to these data and to secure results with a minimum cost in time and labor.

By natural increase is meant, for the purposes of this paper, the increase that was made during the decade 1900-1910 by the population of 1900, independent of the gains from immigration. Since my chief aim is to reckon the potency of our various population areas and communities, the factor of emigration must be considered, since to disregard it would be to

* *QUARTERLY PUBLICATIONS of the American Statistical Association*, Vol. XIV, pp. 711-726.

distort the idea of our real producing ability. This conception of natural increase differs from the one commonly employed, since the latter includes all actual gains by natural increase to the initial population, whether due to its own reproductive processes or to those of immigration.

A considerable degree of positivity attaches to the rate of natural increase estimated for the nation because that rate has been established by two different methods. The first method consists in the use of immigration and emigration to determine what part of the decennial growth of population was due to natural increase and what was the potency of the latter. The second method seeks to establish birth and death rates for the nation, the difference between the birth rate and the death rate being the rate of natural increase. It will be seen that two different estimates of the birth rate are employed and that these are variants of the second method.

The national population in 1900 was 75,994,575; in 1910 it was 91,972,266, a gain of 15,977,691.* This increase of 21.0 per cent. can not be the rate of natural increase of the nation because of the disturbing factors of immigration and emigration.

The factor of emigration necessarily enters into the process of estimating the rate of natural increase of the nation, when the determination of that increase involves the computation of the relative force of the various causes which produce gains and losses in the population. Emigration counts as a loss factor, but nevertheless it is a positive element in calculating the potency of natural increase.

Strange as it may seem our national government has done practically nothing toward recording losses of our permanent population. It keeps a record of emigrant aliens, but statistics which could form a basis of judgment as to the amount of emigration of citizens are scanty and only within the last few years have these data appeared. Consequently my first attempt at estimating the force of this factor was based on the statements of emigration from the United States to Canada published by the Canadian government. The results of the estimate appeared in a recent article in the *Publications of the*

*Abstract of 13th Census, p. 22.

American Statistical Association.* It was reckoned that during the decade 1900–1910, 517,000 individuals settled in Canada† and that enough more went to other parts of the world to bring the total emigration up to 550,000. The present calculations indicate that this amount is approximately correct.

The more recent reports of the United States Commissioner General of Immigration‡ afford data from which an approximation can be made. They record the number of citizens of the United States annually arriving and departing at ports of entry and at the Canadian boundary stations. During the four years, 1911–1914, the excess of departures over arrivals was 296,742. For a ten year period at the same rate, the excess would total 741,830. Assuming that the same relative emigration occurred during the preceding decade, and proportioning the excess to the average population of that decade, the resulting emigration for 1900–1910 is found to be 557,000. This so nearly corresponds to my previous estimate that that estimate may be used unchanged.

We may anticipate the rate of natural increase in the nation to apply to this amount of emigration for finding its total reducing power on our population. Had the 550,000 persons remained in the United States their number would have been increased by one half of 13.7 per cent. making the total loss 588,000.

Since 1820 immigration has been an increasing factor in the growth of our population. The United States has exhibited the most rapid rise in population of all the modern nations, Russia standing as a close second. It is a matter of great importance to determine to what degree our national population of itself contributes to this remarkable advance. How far will immigration account for the decennial rate of gain of 21 per cent.?

In estimating the contribution of immigration, since I am determining the potency of the 1900 population, it will be necessary to reckon the decennial net immigration, and the

*Sept., 1915, p. 645.

†"Immigration Facts and Figures," issued by the Minister of the Interior, Ottawa, Canada, p. 3, gives data for the Canadian estimate.

‡Reports of the Commissioner General of Immigration, United States, 1912, p. 67, and 1914, p. 35.

natural increase for that immigrant population. The first task is simple, the other one difficult because of great complications.

The United States Bureau of Census estimates the net immigration of the decade, 1900–1910, as 5,250,000.* This closely agrees with the results obtained by reckoning that 80 per cent. of the foreign born within the United States in 1900 lived in the United States in 1910† and subtracting the amount from the number of foreign born enumerated in 1910. This gives a net immigration of approximately 5,243,000.

It is necessary to discover how much this net immigration is incremented by its own natural increase during the decade in question. My estimate of 17.4 per cent. as the rate of natural increase for that population was obtained as follows:

The birth rate for immigrants was reckoned by taking the European birth rates of Hungary, Prussia, Germany, Italy, Great Britain, Norway, Sweden and Denmark, France, Spain, Portugal, and Ireland, nations from which we obtain the bulk of our foreign population, and weighting them by the appropriate populations living in the United States. This was found to be 32.8 in 1900.‡ Had we the figures for Russia, the average rate doubtless would be greater.

This average rate of 32.8 must be increased because of the excessive adultness of immigrants. As compared with the population of the United States in 1910, the immigrants of the decade ending 1910 were 59 per cent. more adult, that is, were of the fecund age, 15 to 45, to an extent 59 per cent. greater than the whole population.§ So increased, the birth rate becomes 52.2.

But immigrants have a preponderating maleness. I estimate that females constitute 38.6 per cent. of the net immigrant population.|| Assuming a male for each female, there is an excess of 22.8 per cent. of males over females. The last resulting rate, reduced by this percentage, is 40.5. It is pos-

*Abstract 13th Census, p. 191.

†Census 1910, Population, Vol. I, p. 1017.

‡Abstract 13th Census, p. 188, and Bailey, *Modern Social Conditions*, p. 97.

§Abstract 13th Census, p. 128.

||Estimate from Reports Commission General of Immigration, United States, 1909, 1910, 1911, 1912, 1913.

sible that this rate is too low.* On the other hand, since the birth rate of populations migrating to communities having higher standards of living tends to decrease and since most of the immigrants are derived from rural Europe and settle in cities, it may be concluded that greater economic opportunities here do not largely increase the rate.

A further estimate is necessary before this rate can be applied to the immigrant population. The net immigration of 5,243,000 suffered a death rate during the decade, the decedents being eligible to increasing the population before death. On the basis of the average mortality rate of that decade there should have been enough decedents to swell the child bearing immigration to 5,651,000. From the application of the above birth rate, it is found there would be born 1,130,000 children during that period of time.

But the children born to immigrants suffer a decrease by death during the ten year period. According to a probability curve drawn from Forsythe's Life Tables,† about 18 per cent. of the population dies by the tenth year of age. While this rate may be too low for the class of children in question it must be used because of the dearth of other figures. This reduces the number of children to 916,500. Dividing this sum by 5,243,000, the decennial increase rate for the immigrant population of 17.4 per cent. is obtained. As the result of this series of computations concerning immigration, it is found that there is a numerical population value of the specific net immigration amounting to 6,159,000.

The entire potency of the 1900 population for increase is measured by decreasing the decennial gain in population, 15,977,691, by the total force of the net immigration, 6,159,000, and increasing the result in turn by the amount of emigration plus its increase, 588,000. Dividing the resulting 10,407,000 by the 1900 population, 75,994,575, the resulting percentage, 13.7, is the rate expressing the power of that population to reproduce.

The actual increase, however, is expressed by the percentage obtained by disregarding emigration and the natural increase

*See Ellwood, *Sociology and Modern Social Problems*, p. 176, and Report of Immigration Commission, Vol. 2, p. 497.

†QUARTERLY PUBLICATIONS, Am. Stat. Assn., Sept., 1914, p. 234.

of immigration, a percentage of almost 14.2. This latter percentage is slightly below the figure, 14.8, suggested by the census bureau at the 13th census.* And the potency rate of 13.7 per cent. is also below the census approximation of 14.0.

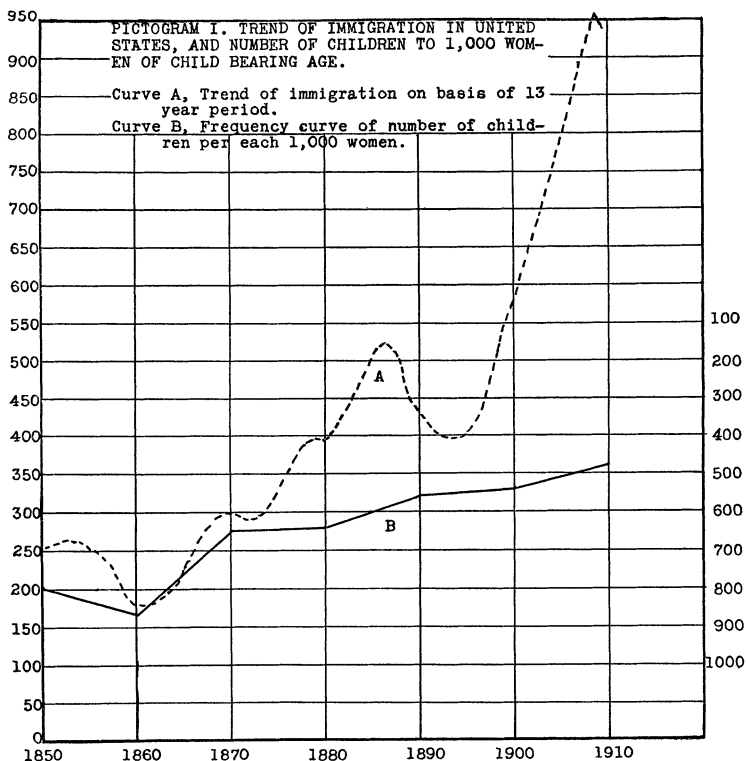
It is seen that immigration contributes a large share of the decennial increase of population. On the basis of the foregoing estimate its contributing power is $21 - 13.7 \div 21 = 34.7$, practically 35 per cent. During the three decades, 1790-1820, previous to the coming of immigrants in force, the decennial increase of population averaged 34.5 per cent., practically all of which was due to natural increase. That rate, less the present rate of 13.7, marks the decline in the rate of natural increase, a decline of over 60 per cent. of the original rate. The earlier rate is over two and a half times as great as the present rate. The consideration of the decline in the rate of natural increase yields a more direct and vivid picture of the movement of a modern nation in the direction of the much discussed "race suicide" than does a study of the decline in the birth rate, because, unless the latter is accompanied by similar study of the death rate, only hazy conclusions can be drawn. For real race suicide occurs only when the death rate exceeds the birth rate.

The question, as to whether or not immigration to this nation has really increased our population, might appear ridiculous in the face of the fact that during the last census decade that influx contributed 35 per cent. of the increase of our population, and likely accounted for quite as large a proportion of the gains during the more recent preceding decades. Yet some intelligent students of the question have so held, claiming that had not the immigrants come in competitive numbers our national rate of natural increase would have continued sufficiently high to offset our gains in population from immigration.

The fact is, however, that the birth rate of the United States was decreasing before the heavier waves of immigration struck our population. This heavy pressure evidently was not serious prior to about 1850. The ratio of foreign born to the population at that date was 1 foreign born person to 9.5 of

*Abstract 13th Census, p. 78.

the population in general. The next decade it rose to 1:7.6, from which it has not greatly varied since that time. The ratio was 1:19 in 1840 and 1:48 in 1830. The two latter ratios are estimated on the basis of the ratios of the successive decennial amounts of foreign born population from 1850 to 1870. Our birth rate doubtless would have decreased had there been only slight or no immigration, since other nations which have received little immigration have suffered a decided decrease of such rate. But it is somewhat apparent that immigration has affected the increase rate of the native stock. This is seen in the relation of the frequency curve (Graph I) of the number of children under 5 years of age per 1,000 women of 15 to 44 years of age, from 1850 to 1910, to the curve of the trend of annual immigration, drawn on the basis of a thirteen year



period, for the same time.* The variations of the former synchronize with the undulations of the latter in a striking manner. Of course, it is possible to say that the conditions which cause the fluctuations in immigration also produce similar changes in the rate of natural increase. No doubt there is a degree of truth in this statement.

Some have sought to demonstrate that it is urbanization which lowers the rate of population increase rather than immigration. Thus Goldenweiser offers selected statistics in support of this contention.† He places in parallel columns the "percentage of population living in the cities of at least 25,000 inhabitants: 1900," the "percentage of population foreign born: 1900," and the "number of children under 5 years of age per 1,000 native white women 15 to 44 years of age: 1900." Upon inspection, he pronounces an apparent correlation between the number of children and urbanization rather than between the former and immigration.

The correlation he considers apparent is not conclusive, however, for upon application of the scientific principle of correlation to his data it is discovered that the coefficient of correlation in favor of the influence of immigration on the number of children is greater than is that of urbanization, the former being .73 and the latter .66.‡ While, from these coefficients, a decisive case cannot be made out for either immigration or urbanization exclusively, yet since the coefficient for immigration is larger than that for urbanization it would appear that the former possesses the greater causal relation to the birth rate.

However, should we regard the factor of foreign born population as a more accurate measure of the pressure exerted on our native born population than the element of immigration, the above conclusion drawn from Goldenweiser's data would have to be reversed, since the coefficient of correlation between the foreign born factor and the number of children to 1,000

*For estimates of number of children, see article by Walter F. Willcox, *QUARTERLY PUBLICATIONS* of the American Statistical Association, XII, p. 491; the trend of immigration was made from data given in the Reports of the Commissioner General of Immigration.

†*American Journal of Sociology*, Vol. XVIII, pp. 348-350.

‡I desire to acknowledge my indebtedness to my colleague, Dr. George R. Davies, for suggesting the correlation between the frequency curve of children of fecund women and the fluctuations in immigration, and for the coefficients of correlation between the various factors in Goldenweiser's table.

women of child bearing age is only .38. Probably there is good reason for thinking of the pressure exerted by the foreign born on our native population as the truer index, since it is the permanent factor in the situation, immigration fluctuating according to conditions.

No doubt immigration has been a factor in causing a reduction of the birth rate in the United States, but that it is the sole factor cannot be sustained in the face of the fact that other states and nations having little or practically no immigration have sustained quite as large or greater decrease in their birth rates. That urbanization is an important causal factor in reducing the birth rate must be concluded from an inspection of the decennial rates of natural increase presented in columns 8 and 9 of Table I. When it is noted that the rural rate is almost twice the urban rate for the nation as a whole, that in only one division does the latter exceed the former, and that in some divisions the rural rate is three times the urban rate, it can scarcely be doubted that the factor of urbanization is the most important cause of lowered increase rates. Urban birth rates are lower than rural birth rates and its death rates are higher than those of the latter.

The task of securing rates of natural increase for rural and urban communities is a difficult undertaking, because data for their immediate determination are deficient. Had we mortality and birth data for them it would be a simple matter to obtain their difference. But trustworthy registration of births obtains for only New England and a few cities in other divisions, and the registration area for deaths embraces only about two thirds of the national population, many states and some divisions being without complete registration. And while nothing like an exact estimate can be made in view of these conditions, I believe it is worth while to make an initial calculation, trusting to time either to perfect it or to develop complete registration of births and deaths.

One method of securing natural increase rates for rural and urban districts is to find a substitute method of deriving births and to approximate death rates in states not having them.

If the census reported the number of children living in urban and rural communities under one year of age, we need only

to discover the portion of children who had died to obtain the number born. But the best the census does is to give the number of children under five years of age living in such districts.

By the use of a frequency curve constructed from data furnished by Forsyth's Life Tables* it is possible to calculate the average age and conversely the average number of children who died within the five year age group. The life table represents the elimination by death obtaining among a given number of persons all of whom begin life at the same moment, and it might appear that a probability curve erected on such a basis would misrepresent a curve constructed from the data of an actual population in which at each point of time, during the five year period, infants are being born. But an analysis of the latter data shows that the two situations are similar and that their probability curves are practically identical. For the whole United States population such a curve yields approximately 86 as the average percentage of children, out of all those born during the five years, who are living: conversely the average percentage dying is 14.

But the life table does not distinguish between cities and country and it is most likely that child mortality is somewhat greater in the former than in the latter. Evidently the rural percentage should be less and the urban percentage more than 86. The approximately correct percentage in each case was determined by the following method of calculating rural and urban mortality rates for rural and urban children under 1 year of age, discovering their ratio, and applying it to the five year age group.

Of the Negro population, 2.6 per cent. and of the white, 2.4 per cent., are under 1 year of age.† But the application of 2.4 per cent. to both rural and urban populations does not yield the total number of children of that age. For the national population, also, 9.9 per cent. of the urban and 13.0 per cent. of the rural are under 5 years of age. The same disproportion must be true of children under 1 in the groups, since the ratio of registered deaths in rural districts of the one year and five

*QUARTERLY PUBLICATIONS, Am. Stat. Assn., Sept., 1914, pp. 228-235.

†Census 1910, Vol. I, p. 314.

year age groups and that in urban districts of similar age groups are almost identical, being 72.0 and 71.3, respectively. Hence, with 2.4 per cent. as a basis, multiples which, applied to urban and rural populations, will produce the census number of children under 1 year of age, may be obtained by trying out 2.39, 2.38, etc., for urban and 2.41, 2.42, etc., for rural. It is found that 2.25 applied to the urban population and 2.55 applied to the rural population produce the census number of children under 1, a difference of 6.2 per cent. in favor of the rural. Proceeding in the same manner relative to Negro infants, the corresponding rates of 2.2 and 2.8 are established.

From the Mortality Report* it is possible to estimate the number of Negro children who survived at the end of a year by taking 2.8 per cent. of the rural and 2.2 per cent. of the urban population, and by the use of the number of deaths reported in each case, estimate the infant death rates. The consequent rural Negro infant death rate is 11.6, and the urban rate is 18.7. The rates established for white infants are: rural, 7.96; urban, 11.9. Weighting the rural rates in each case by their respective white and Negro populations and treating the urban rates in like manner, there ensues a rural infant death rate of 8.5 and an urban rate of 12.3. Should we desire to weight these in turn by their respective populations, a national infant death rate of 10.25 is established.

Granting that the same difference between the rural and urban death rate for children under 5 exists as for those under 1, it is not difficult to determine how the previously obtained 86 per cent., the average percentage of children under 5 who are living out of all who were born, is to be distributed to rural and urban groups. For if $(91.5 + 87.7) \div 2 = 89.4$, then $\frac{x+y}{2} = 86$.

Then $91.5 : 87.7 :: x : y$. Whence x equals approximately 88 and y equals approximately 84. Hence the average percentage of rural children under 5 who survive is 88, that of urban children, 84.

We may proceed now to apply these rates to rural and urban populations. In 1910 there were 4,200,291 urban children under 5 years of age. Since these represent 84 per cent. of

*1911, p. 150.

those born, the number of births must have been 5,000,000. Dividing this number by the urban population midway between 1907-1908, a rate of 25.2 is secured as the birth rate. Proceeding to apply the rural percentage, 88, in the same manner, a rural rate of 30.3 is obtained.

As a result of applying 84 per cent. to the urban population of each of the divisions of the United States and 88 per cent. to their rural populations, urban and rural birth rates are established for the nine divisions. These birth rates will be found in columns 1 and 2 of the accompanying table, Table I. Column 3 contains the birth rates of the several division populations. These rates were established by weighting the rural and urban rates with the rural and urban populations of 1900. It is seen that division rural birth rates have a range of over 16, the lowest being 21.0, New England, and the highest, 36.4, West South Central. There is a much smaller range in the urban communities, the Pacific being the lowest, 20.4 and the West South Central the highest, 27.0. As to division rates, the Pacific has the lowest, 23.1, the West South Central the highest, 34.1. To most persons it will be a surprise to learn that the Pacific division has a lower birth rate than New England.

TABLE I.

RATES OF BIRTH, DEATH, AND NATURAL INCREASE IN THE UNITED STATES FOR THE DECADE 1900-1910.

Division.	Birth Rate.				Death Rate.			Rate Natural Increase.		
	Rural.	Urban.	Total.		Rural.	Urban.	Total.	Rural.	Urban.	Total.
			Present Estimate.	Children's Bureau Estimate.						
New England..	21.0	24.4	23.6	24.4	16.0	17.1	16.9	5.0	7.3	6.8
Middle Atlantic	25.5	26.4	26.0	26.2	14.8	16.8	16.2	10.7	9.6	10.4
East North Central.....	25.2	24.7	25.2	24.2	12.8	13.9	13.4	12.4	10.8	11.6
West North Central.....	28.4	22.5	26.3	25.5	10.3	12.4	11.0	18.1	10.1	15.8
South Atlantic.	34.4	25.4	32.1	31.2	15.5	19.4	16.4	18.9	6.0	16.0
East South Central.....	34.4	25.4	32.2	31.6	14.7	18.0	15.3	19.7	7.4	17.8
West South Central.....	36.4	27.0	34.1	32.2	12.5	16.8	13.4	23.9	10.2	21.6
Mountain.....	31.6	25.5	29.4	27.0	10.5	15.0	12.1	21.1	10.5	17.6
Pacific.....	24.6	20.4	23.1	19.9	12.0	13.8	13.0	12.6	6.6	9.8
United States	30.4	25.2	28.6	(27.1)	13.5	16.4	14.7	16.9	8.8	13.65

It will be noted that the New England and Middle Atlantic divisions are the only ones in which the rural birth rates are lower than the urban. This is probably due to the large foreign born population, chiefly urban, with its high birth rate. The Southern divisions generally, show a much greater difference in this respect than do any other divisions, the disparity arising from large variations in the rural rates, there being no pronounced fluctuations in the urban rates. The presence of the prolific Negro population in those divisions doubtless accounts for this condition.

With the above division birth rates may be compared the estimates of the United States Children's Bureau.* The fourth column, Table I, contains these estimates. That for the United States in this column results from totaling the number of children reported for the various divisions and dividing by the population of the United States. The two sets of estimates are not far apart, save in the last three divisions. The author's estimate is, however, supported by the following evidence: First, the rate for the nation, 28.0, obtained by weighting the division rural and urban rates is almost identical with the national rate, 28.1, secured by obtaining separate birth rates on the basis of the total number of rural and urban children under 5 in the whole nation and proceeding to weight them. Second, these rates agree with that obtained by treating the children of the nation, irrespective of divisions, and of the rural and urban communities. Third, the rate of natural increase for the United States as determined in the earlier part of this paper, is almost identical with that obtained by the use of the birth and death rates presented in Table I.

As has been indicated, the mortality rates contained in the United States Mortality Reports, cover only about two thirds of the national population, none being available for many states and for one entire division. Yet the distribution of the area from which reports are made is such that a mortality rate may be approximated for neighboring and similar areas. Space does not permit of giving the reasons for my estimates for the various states that do not report on mortality. Suffice to say, I have given each state careful attention.

*Birth Registration, Monograph No. 1, 3d edition, 1914, p. 18.

The mortality estimates in Table I were made on the basis of the data given in the Statistical Abstract of the United States.* Column 5 presents the simple average of published and approximated mortality rates of the states as urban rates by divisions, and column 6 contains the same results for urban communities by divisions. The rates presented in column 7 were obtained by weighting the rural and urban rates in columns 5 and 6. The national rural and urban death rates are the average for the five years, 1906-1910, that for the nation as a whole represents the weighting of all the division rural and urban rates.

The rates for the West North Central and the Mountain divisions seem low. It is possible that they are too low, but it is to be remembered that it is altogether probable that both the climatic conditions and the age distribution of the populations of these divisions are favorable to the existence of low rates. The reports of mortality from such states as make reports may all be wrong, but the reports we get certainly indicate that the conditions of life in those sections favor longevity.

Columns 8, 9, and 10 of Table I, embody the results, for most part, derived from a treatment of the rates contained in the columns under Birth Rate and Death Rate. The rural column exhibits a relatively steady increase of rates, beginning with New England and proceeding toward the Pacific. A vast fluctuation in these rates is obvious, those of the West South Central and Mountain divisions being from four to five times the New England rural rate. It is seen, that should the indicated rate persist, the West South Central division would almost double its population in four decades by natural increase alone. In the same manner it would require New England 200 years to accomplish that result.

The urban column offers its surprises in that three other divisions show as low a rate of natural increase as either New England or the Middle Atlantic. Since the Negro population in the South is largely a rural population, it is plain that the native white stock of the southeastern divisions are multiplying about as slowly as is that of rural New England. The native white stock of urban New England is doubtless in the

*1913, pp. 74-75.

same or even in a less fecund condition, since its urban rate is largely sustained by the more prolific immigrant stock. It is also noteworthy that the Pacific urban rate is less than that of New England. This is partly due to the fact that the population of this division contains an unusually large percentage of individuals from 25 to 44 years of age and of unmarried males and females. It is probable also that the native stock has approximately the same tendency toward infecundity exhibited in New England and the southeastern cities.

The national rural and urban rates in each instance are derived in the same manner as are the division rural and urban rates, by taking the difference between the national birth and death rates. It certainly is a matter of surprise that the rural rate is almost double the urban rate. The assumption which is found repeatedly in published works is that the urban birth rate exceeds the rural rate, and the conclusion is usually drawn that the natural increase of the former is consequently greater.

The total rates of natural increase are the weighted averages of the rural and urban rates, division by division. As in the case of the rural column, a progression is noticed in the size of the rates from New England down to the West South Central division, a decline occurring after that. The Pacific rate approximates that of the Middle Atlantic. That of the West South Central division is more than three times that of New England and over twice that of the Middle Atlantic or the Pacific. Those who believe in economic determinism will find comfort in this column, for it is apparent that the rate of natural increase largely follows the pressure or freedom from pressure of economic opportunities. However, a second thought reveals the fact that race and standards of culture play a large rôle, because the highest rates are in the division that include the bulk of the Negroes, where heavy breeding occurs in spite of their backward economic conditions.

When the results embodied in the last three columns of Table I, especially those of the rural and urban rates, were obtained, the writer was inclined to think a huge mistake had been made. But a careful and repeated reëxamination of the data and processes on which the results depend compel him to think the findings are essentially true. Should it be said that

the birth rates are too high or too low, the reply is that they must be so for all of the divisions, for the same method was applied to all data alike. And should it be said that the mortality rates for certain of the divisions are too low, the answer is that then they are too low alike for the rural and urban communities of the divisions, for the same method was applied in every case. The result would be that there might be a small modification of urban and rural death rates in some divisions, and a slight lessening of the natural increase rates in general due to a uniform reduction of the birth rates. But the results would not be changed greatly. Consequently, Table I gives a comprehensive and, I believe, a fairly accurate picture of the situation for the United States as a whole, for the several divisions, and for rural and urban communities as regards the vital facts of natural increase.

In concluding this treatment of natural increase, I desire to remark on the close agreement existing between the rate of natural increase, 13.65, to be found at the foot of column 10, Table I, and that of 13.7 obtained by an analysis of the population increase between 1900 and 1910 into its factors of emigration, immigration, and native born. The latter percentage, 13.7, was first obtained and the fact that the former percentage was so nearly identical was regarded as an indication that the methods by which it was secured were reliable. To the writer, this agreement is no small evidence that the birth rates and the death rates contained in Table I are approximately correct. Were they considerably modified the resulting rate of natural increase for the nation would, by the amount of the modification, fail to agree with the first established rate.

One of the most interesting undertakings in the field of the statistics of population is that which deals with the factors that account for growth of population and seeks to accord to each one its relative force in producing the change. Little of a scientific analytical character has been done toward the accomplishment of this object and the territory is practically a virgin one. We know relatively nothing in an exact way regarding the forces at work in the population of our nation until this task is accomplished, and the hope of contributing something that will serve as a foundation for further attain-

ments in that direction is a sufficient spur to drive a worker into this complicated and difficult field.

The elements that enter into the rural and urban changes of our national population in the direction of determining its growth are: natural increase, emigration, immigration, incorporation, and rural migration.

In round numbers the increase of urban population during the last census decade was 11,826,000. This is to be credited to incorporation, immigration, and natural increase. Had it not been for emigration the gain would have been larger. This emigration from urban districts amounted to 294,000, therefore the potential urban increase for the decade totals 12,120,000.

According to the Census, incorporation means three things: the addition of suburban territory to urban districts; the growth of rural villages past the 2,500 population point, the dividing line between rural and urban communities; and the falling back of some urban communities into the rural class. During the decade, ending 1910, approximately 813,000 inhabitants passed over into the urban group according to the census figures. Computing the increase of this population by applying the national natural increase rate already established, the final urban increment by incorporation is found to be 924,000, or 7.8 per cent. of the urban increase.

Immigration is the largest factor in accounting for the increase of urban population. The foreign born population of the United States in 1900 was 10,341,276; in 1910, 13,515,886. In 1900, 66.8 per cent. of the white foreign born population was urban, and in 1910, 72.2 per cent. Consequently the urban foreign born in 1900 must have been 6,908,000 and that of 1910, 9,745,000. To the former number belongs also that portion of the foreign born rural population which became urban by 1910, a sum of 111,000, swelling the 1900 urban foreign born population to 7,019,000. Since, as we have seen, but 80 per cent. of this population remains by 1910, or 5,615,000 the net immigration for the decade was 4,130,000. Increasing this sum by 17.4 per cent., the rate formerly established to represent the decennial natural increase of immigrants, it is found that the national urban population was enlarged by

reason of immigration, by 4,849,000, or 41 per cent. of the total urban gain.

How far is the urban gain in population to be accounted for by the natural increase of the population resident in urban districts in 1900? Our urban rate of natural increase has been established during the preceding treatment (See Table I, column 9). Applying this rate, 8.8 per cent., to the urban population of 1900, 30,797,000, gives 2,710,000 as the amount of such natural increase. But since urban populations sustained a decennial loss of 294,000 by reason of emigration and since, it may be assumed, this loss was sustained chiefly by the population that was present in 1900, the amount of natural increase may be diminished by the amount of emigration, leaving a balance of 2,426,000 to be assigned to natural increase. This represents 20.5 per cent. of the urban decennial gain.

It is now possible to estimate the amount of rural immigration by taking the difference between the sum of the ascertained factors and the decennial urban increase. In round numbers this amount is 3,637,000, or 30.7 per cent. Hence we may gather the results in Table II:

TABLE II.
FACTORS OF URBAN INCREASE FOR THE UNITED STATES AS A WHOLE, 1900-1910.

Factor.	Amount.	Per Cent. of Urban Increase.
Incorporation.....	924,000	7.8
Immigration.....	4,849,000	41.0
Natural increase.....	2,426,000	20.5
Rural migration.....	3,637,000	30.7
Total.....	11,826,000	100.0

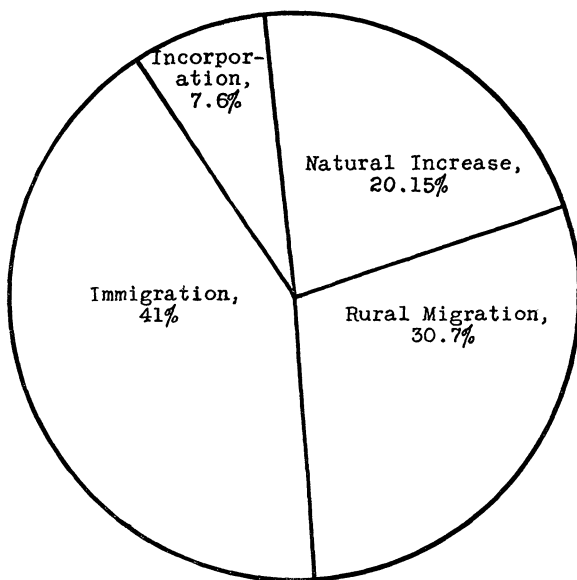
The results of this table may be presented in graphic form.

The proportion of these urban factors to each other differs but slightly from that given in the published estimate* previously referred to. But my figures vary widely from those given by Mr. Earl Clark in his paper "Contributions to Urban Growth."† Mr. Clark did not seek, however, to estimate the amount net immigration is swelled by its own natural increase which is found to represent over 718,000 persons. Neither

*See QUARTERLY PUBLICATIONS of the Am. Stat. Assn., Sept., 1915, p. 649.

†*Ibid.*, p. 671.

GRAPH II. RELATIVE FORCE OF FACTORS DETERMINING URBAN INCREASE IN THE UNITED STATES, 1900-1910.



did he deal with the factor of incorporation which we have seen affects the situation in various ways, although he excludes the incorporated population from his total urban increase. It may be said further, that he did not have the advantage of the detailed results of the work on natural increase of population which are presented in this paper.

It will not be necessary to indicate the detailed calculations made in arriving at the results representing the factors concerned in the rural increase for the United States during the decade. The methods and processes were in general similar to those involved in the urban analysis. It is well to note, however, that both incorporation and rural migration in Table II represents rural losses, in addition to the factor, emigration. Thus, to secure rural migration, from the sum of immigration and natural increase is taken the sum of incorporation, emigration, and census estimate of rural increase.

These amounts are as follows: Immigration, 1,290,000; natural increase at rate 16.9, 7,638,000; total gain in popu-

lation, 8,928,000. From this is taken: Census increase, 4,151,000*; incorporation, 924,000; emigration, 294,000; total, 5,369,000. The difference, which represents rural migration, is 3,559,000.

The results of rural analysis for the nation as a whole are embodied in the following table:

TABLE III.

FACTORS OF RURAL INCREASE FOR THE UNITED STATES AS A WHOLE, 1900-1910.

Factors.	Amount.	Per Cent. of Census Increase.
Immigration.....	1,290,000	31.0
Natural increase.....	2,861,000	69.0
Total.....	4,151,000	100.0

It is observed that only about 37.5 per cent. of natural increase of rural communities is devoted to accounting for the Census increase, the remainder being accounted for under the three factors of loss: emigration, incorporation, and rural migration. It must also be noted that the total rural increase is not the Census statement of increase but an amount derived by subtracting the rural population of 1900 living in territory that was rural in 1900 from the rural population living in rural territory in 1910. This is made necessary to permit the use of the factor of incorporation in estimating the force of rural migration. A difference of over 80,000 appears between the estimates of rural migration made for rural and urban populations. We shall find further variations from both of these estimates, as for the other factors, when we arrive at a closer analysis of rural and urban populations by divisions. Such variations are to be expected because of some uncertain elements in the computations, but it is hoped that they do not greatly militate against the value of the estimates.

It might seem a perfectly simple matter, since the force of each of the various factors has been determined for the nation relative to urban and rural districts, to apply the results to the divisions. But a consideration of a single division reveals new difficulties. Thus, how is emigration to be distributed

*Abstract 13th Census, 1910, p. 56.

among the several divisions so that each shall have its actual amount? And what is to be done with the new element in the situation, namely, the interdivision migration of native born persons?

To treat in detail each division, and to do the same for the urban and rural districts in each division, would require too much space. We shall have to be satisfied with a somewhat syncopated handling of a single division and the presentation of the results from the other divisions in a comprehensive table. Divisions as a whole will first be considered; then a treatment of their urban and rural districts will be undertaken.

I have selected the Middle Atlantic division to illustrate the method of making estimates. Any other division would do equally well, since a uniform method is employed. The force of immigration is ascertained exactly as it was for the nation as a whole, and for the national rural and urban districts. The net immigration for the decade so ascertained is 2,197,466, its natural increase at 17.4 per cent. is 382,000, giving a total immigrant contribution beyond the population of 1900 of 2,579,000. Since the increase of population for the division as recorded by the Census was 3,861,214, immigration with its natural increase constitutes about 67.0 per cent. of such increase.

Since emigration enters into the calculation of the potency for natural increase of the 1900 population it must be regarded. Had we to consider only accounting for the Census amount of increase it might be disregarded. Its consideration also is demanded as a foundation for calculations relative to the factor of rural migration to be determined hereafter.

There is no certain indication for distributing the effect of emigration among the divisions. One might expect that the drain from some divisions would be proportionately larger than from others. I have made calculations for all entire divisions, as well as for their respective separate rural and urban parts on the basis of several different assumptions. The criterion of availability applied to these methods, as also of those regarding the various modes of treating interdivision migration of native born Americans, has been their effect on the amount of rural migration as separately determined for

rural and urban regions (Tables II and III). In each case, I have concluded that the one which secured most nearly identical sums of rural migration in the respective divisions when determined by the two processes of analysis, rural and urban, was the one most nearly correct. As a consequence I have returned to my initial plan of distributing the effects of emigration among the divisions in proportion to their population, and within divisions between urban and rural according to their respective populations.

In 1910 the rural and urban populations of the United States were so nearly equal that the sum of emigration was halved and an equal portion allotted to city and country alike. Since the total amount, not increased by natural gains, was estimated at 550,000, urban and rural regions would each suffer a loss of 275,000. Middle Atlantic urban population in 1910 formed 32.2 per cent. of the total national urban; hence its allowance of emigration was 88,500. In like manner rural Middle Atlantic, since its population was 11.3 per cent. of the national rural, was assigned 31,050. Since the decennial urban rate of natural increase is 9.6 per cent. (Table I) and the rural 10.7, the assigned sums are increased to 93,400 and 32,650, respectively. The urban amount, 93,400, constitutes approximately 2.4 per cent. of the Census increase of the division.

According to the Census report* Middle Atlantic, in 1910, had 932,467 more persons born within the division who lived outside it than it had native born of other divisions living within itself. But compared with the record of 1900, when the difference against Middle Atlantic was 1,088,150, the division really gained in native born; that is, the division was 155,683 better off in 1910 than in 1900. The first assumption likely would be that the latter amount is the sum we need and represents a gain in population. But, as is the case with other factors, logical analysis of the situation is found to be necessary in order that the true force of the migration of this element may be discovered.

Each division relative to the native born migrant must be viewed and treated just as the nation is viewed and treated

*13th Census, Vol. I, p. 693.

relative to foreign born. There is an inflow and an outflow, births and deaths, and these modifying factors must be measured. Hence a double analysis must be made; one for those born in the division but living outside for 1900 and 1910, and one for those born outside but living within for both dates.*

For Middle Atlantic in 1900, persons born in the division but living outside numbered 1,808,060. These would suffer inroads by death during the decade, and I have used the national decennial death rate of 15 per cent. for all divisions. I consider this better than the separate division mortality rates, since there is no way of knowing what length of time the migrants have been acted on by the local rate. Consequently only 1,538,000 are living by 1910. In 1910, those who are born in the division but live outside it number 1,881,406. The difference, 343,400, between this sum and 1,538,000 represents the gain in the number living outside the division.

In the same manner, persons born outside Middle Atlantic living inside in 1900 numbered 719,910 of whom 620,000 are living in 1910. Persons of the same character at the 1910 Census number 948,939, the difference between this and the survivors representing a net gain of 329,000.

These amounts, 343,400 and 329,000, are also influenced by the decennial rate of natural increase. For the same reasons given for the use of the national instead of the local death rate, I chose the national rate of natural increase, 13.7. Applying this rate to each amount, they become 367,800 and 352,000 respectively, wherefore their difference, 15,000, represents the loss of native born to other divisions Middle Atlantic sustains. Hence what seemed to have been a great loss, the Census 155,683, by analysis of the situation appears as a small one. And the same is true in the case of all eastern divisions whose census record appears positive.

Having ascertained the value of each of the factors, immigration, emigration, and migration of native born, it is possible to discover the amount of natural increase by a new method. Since the latter two factors represent losses of the 1900 population, they must be added to the Census increase of 1910 to discover what the full potency of the former population act-

*For Census data, 13th Census, Vol. I, p. 692.

ually was, giving a total sum of 4,002,264. From this is taken immigration, 2,579,000, leaving the amount of natural increase, 1,423,264. Dividing the latter amount by the population of 1900, a rate of natural increase of 9.2 for the division is obtained. By our other method of securing the division rate of natural increase, a rate for the Middle Atlantic division of 10.4 was established.

When the same method is applied to each of the other divisions as was just applied to the Middle Atlantic, the data to be found assembled in Table IV are obtained.

Relative to this table of results some remarks are pertinent. Lest there be a misunderstanding as to what the totals imply, it is sufficient to say, first, that column 5 plus column 7 less column 2 should equal the total in column 1. The difference is about 23,000. Second, the total in column 2 should equal the original total estimated for the United States, 588,000. The difference is seen to be slight. Again columns 3 and 4 should balance, but the difference is only about 5,000. Finally, the force of immigration as originally estimated for the nation was 6,159,000, as compared with the total of 6,153,000 of column 5. A portion of these small differences no doubt are due to the use of the slide rule in most of the hundreds of computations involved in evolving the table. Some of the differences are evidently due to the application of uniform rates of death and natural increase to widely differing populations, as in the case of immigration and of the native born migrants. But considering the complexity involved, it is rather remarkable that the divergences are not greater. For instance, to secure the amount of natural increase for the several divisions and the nation involved the treatment of the new factor, native born migration, yet the difference between the total so secured, 10,429,000, differs from the original estimate, 10,412,000, by only 17,000.

Only three divisions, all western, add to their population by means of an actual excess of income over outgo of native born Americans. Column 6 shows that immigration contributes slightly to the increase in the South and Southeast but that its force in that direction is preponderant in the North and Northeast.

TABLE IV.
FACTORS ACCOUNTING FOR INCREASE OF POPULATION BY DIVISIONS, 1900-1910.

Division.	Loss.		Gain.				
	Increase According to Census.	Emigration: Number with Increase.	Migration Native Born: Number with Increase.	Immigration.		Natural Increase.	
				Number with Increase.	Per Cent. of Census Increase.	Amount.	Rate.
New England.....	960,664	42,830	22,000	784,000	81.5	241,494	4.3
Middle Atlantic.....	3,861,214	126,030	15,000	2,573,000	66.7	1,423,364	9.2
East North Central.....	2,265,040	116,400	688,000	1,142,500	50.0	1,927,200	12.0
West North Central.....	1,200,500	78,400	688,000	457,906	35.5	1,563,900	15.2
South Atlantic.....	1,751,415	75,840	104,000	148,270	8.0	1,781,985	17.1
East South Central.....	892,144	53,960	457,700	18,050	2.0	1,355,800	17.0
West South Central.....	2,252,244	55,500	470,000	162,622	7.2	1,675,000	25.5
Mountain.....	958,860	16,700	450,800	245,597	26.0	276,160	16.5
Pacific.....	1,755,612	26,300	1,006,000	609,827	34.5	186,700	7.7
Total.....	15,977,669	581,600	1,937,000	6,153,000	....	10,429,000	....
				
				

Column 8 gives the rates of natural increase established by the method of division analysis. In general, they confirm the findings in Table I, column 10. In four divisions the difference of rates is less than 1 per cent., in two others slightly more than 1, in two others between 2 and 2.5, and in one 3.9. Nor is one set of rates uniformly higher than the other. Thus the rates in Table I exceed those in Table IV only in the New England, Middle Atlantic, West North Central, Mountain, and Pacific divisions. The weighted average for all the divisions gives practically the same rate of natural increase for the United States as obtained by the other method, 13.7 vs. 13.65, and agrees with the rate previously established for the nation.

The difference between the two sets of rates may be due, in New England, to the fact that the estimated rate of natural increase for immigration is larger than conditions of life in that division justify. If this assumption is true, the new rate of natural increase for the division population would be increased by that much. The very large rate in the West South Central division may be due to applying the national mortality rate to the native born migrants treated relative to that division, when the local death rate is higher and should have some influence in the estimate. However, I know of no means of taking such considerations into account.

The actual contribution to the division increase as recorded in the Census, given in column 10, differs from the amount of natural increase. In the first six divisions this contributive amount is ascertained by obtaining the difference between the Census increase and immigration; in the last three divisions, by finding the difference between the Census increase and the sum of immigration and native born migration. In the case of the East South Central division it is apparent that the Census increase would have been over one and a half times its actual amount had the native born loss not occurred.

The factors which enter into the determination of the urban increase in each of the various divisions are those discovered in making calculations for each division as a whole, together with the new elements of incorporation and rural migration, both of which entered into the analysis of the national increase with respect to urban and rural. The force of the various

TABLE V.
URBAN INCREASE IN THE UNITED STATES, 1900-1910.

Factors Affecting Urban Increase.																
Losses.			Gains.													
Division.	Increase According to Census.	Emigration.	Interdivision Migration of Native Born.			Immigration.		Incorporation.		Natural Increase.				Rural Migration.		
			Amount.	(Gain).	Per Cent. Census Increase.	Amount.	Per Cent. Census Increase.	Amount.	Per Cent. Census Increase.	At Rate.	Per Cent. Census Increase.	Contribution to Census Increase.		Amount.	Per Cent. Census Increase.	
												Amount.	Per Cent.			
New England.....	985,166	32,150	18,160	.....	.....	742,000	75.4	20,800	2.2	210,000	4.7	21.3	150,000	16.2	62,800	6.3
Middle Atlantic.....	3,288,600	92,800	10,620	.....	.....	2,207,000	61.0	254,000	7.2	326,000	7.3	33.0	213,000	21.5	53,800	0.7
East North Central.....	2,397,000	65,300	362,000	.....	.....	1,005,200	42.0	182,000	7.2	975,000	9.6	23.8	513,000	15.6	314,575	8.7
West North Central.....	827,172	26,400	221,500	.....	.....	261,640	28.0	83,820	9.0	297,000	10.8	13.3	342,700	14.2	897,400	27.8
South Atlantic.....	859,521	20,640	27,100	.....	.....	90,000	10.5	111,300	13.4	134,000	6.0	32.0	49,460	5.3	532,232	57.0
East South Central.....	443,173	12,180	83,600	.....	.....	14,100	0.6	59,200	13.4	83,600	7.4	15.6	186,060	21.5	572,161	68.5
West South Central.....	900,259	13,450	.....	.....	.....	70,700	7.9	110,200	13.0	108,000	12.0	12.0	118,550	13.2	519,809	50.5
Mountain.....	406,148	6,370	.....	.....	.....	102,500	25.3	37,600	9.2	57,000	10.5	13.8	50,630	12.5	519,809	13.1
Pacific.....	1,280,000	15,900	.....	.....	.....	392,500	31.0	62,300	5.0	74,200	6.6	5.8	58,300	4.6	174,900	13.9
Totals.....	11,826,198	285,190	839,000	722,000	.....	4,885,640	.....	921,220	.....	2,721,400 or 2,837,400	.....	.....	1,404,248 or 1,517,248	.....	3,468,272 or 3,405,472	.....

(a) Loss.

factors was reckoned much as was the rural and urban gains for the nation as a whole.

The results established by the analysis of these factors determining urban increase in each of the nine divisions have been brought together in the preceding table.

The amount of emigration and of native born migrants were obtained by apportioning the division total in each case (Table V, columns 2, 3, and 4) between the rural and urban districts of the division according to their population. As in the distribution of emigration among the divisions there seems to be no other principle to use in the apportionment. The force of immigration is obtained by the treatment of the urban foreign-born of 1900 and 1910 according to the method previously developed. The factor of incorporation calls for no explanation, except that it represents the population in the division that became urban between 1900 and 1910,* and that since it is involved in the process of reckoning natural increase, according to the meaning adopted in this paper, it cannot be disregarded. The amount of natural increase is found by the use of the division rate for urban population (Table I, column 8). It is impossible to determine it by a process of exclusion as was done in estimating the amount of rural migration. Thus, in the Middle Atlantic division, rural migration equals the difference between the sums involved in columns 1 to 3 and 6 to 10, Table V.

New England gives some difficulty respecting its rural migration. If the process applied to the Middle Atlantic division is employed, it is found that not only is there no population left to rural migration, but at the urban rate of increase for the division, 7.3 per cent. per decade, there is a deficit of nearly 54,000. A similar deficit occurs when the same operation is performed for the New England division as a whole. Evidently, local conditions make some of the rates established inapplicable unless qualified. Which of the factors is overrated, or whether several are involved, there is no cue to determine.

An attempt has been made to estimate what proportion of the urban increase of the several divisions is to be assigned to

*Abstract 13th Census, pp. 56-57.

each factor helping toward the gain. The results uniformly occur in the columns headed "per cent. of census increase." It will be noted that columns 13 and 14 estimate the contributive power of natural increase. The same might have been undertaken for any of the other factors of increase, instead, but it is more appropriate for natural increase, since it aids us to see how far natural increase is being displaced by other sources of population. In the case of New England, two estimates are given for natural increase and rural migration; one based on the established urban rate for the division; the other, on a rate obtained by proportioning the division rate of natural increase (Table I, column 10) to the urban part of the division population. With the smaller rate, not only are the amount and contributive force of natural increase enlarged, but the deficit in rural migration (column 15) is turned into a surplus.

Should a comparison be made between the totals for columns 2, 6, 8, and 10, with the estimates for each of the items made previously in this paper, it would be found that some variations from those estimates appear. Using round numbers for the previous and the present computations in their order the estimates are: immigration, 4,885,000 vs. 4,849,000; emigration, 285,000 vs. 294,000; incorporation, 922,000 vs. 924,000; natural increase, 2,721,000 or 2,837,000 vs. 2,710,000; and rural migration, 3,405,000 or 3,468,000 vs. 3,637,000 or 3,559,000. These variations are partly due, presumably, to the use of the slide rule and to local conditions which refuse to conform to general formula, chiefly the latter. The gains and losses due to interdivision migration of native born should balance, but it is observed that they are about 84,000 apart. It is obviously possible that apportioning this factor to urban and rural communities according to population fails to meet the exact needs of the situation.

In using the foreign born population of 1900 and 1910 in order to estimate the net immigration for the decade, it was necessary to reckon the total number from the number of foreign born whites given in the 13th Census.*

Table VI, which presents the results of a series of estimates to discover the force of the various factors determining the

*See Census 1910, Vol. I, pp. 175, 189, and 781.

TABLE VI.
RURAL INCREASE IN THE UNITED STATES, BY DIVISIONS, 1900-1910.

Division.	Increase According to Census.	Factors Affecting Rural Increase.									
		Gains.					Losses.				
		Immigration.		Natural Increase.			Migration Native Born.		Emigration.	Incorporation.	Rural Migration.
		Amount.	Per Cent. Census Increase.	Amount.	At Rate.	Per Cent. Census Increase.	Contribution to Census Increase.	Amount (Gain).	Per Cent. Census Increase.	Amount. (Loss).	
				Amount.			Amount.				
New England.....	(a) 24,502	1,140	.....	35,129	3.2	.....	.....	.....	6,330	1,840	44,628
Middle Atlantic.....	213,724	371,139	17.4	56,109	5.0	.....	.....	.....	32,650	4,380	24,448
East North Central.....	(a) 132,256	135,338	.....	530,729	10.7	260.0	.....	.....	32,650	326,000	417,634
West North Central.....	363,236	1,000,109	54.0	1,086,084	12.4	368.0	.....	.....	51,200	439,000	767,378
South Atlantic.....	891,894	500,200	6.6	1,170,000	18.1	172.0	.....	.....	47,000	76,900	602,454
West Atlantic.....	418,971	400,000	0.9	1,532,014	18.9	172.0	.....	.....	55,200	76,900	456,610
East South Central.....	1,351,985	91,022	6.8	1,251,117	19.7	208.0	.....	.....	41,800	373,400	363,606
West South Central.....	452,712	1,000,000	32.0	1,281,000	23.9	95.0	.....	365,200	42,500	12,300	228,806
Mountain.....	515,639	1,000,000	42.0	1,311,000	21.1	51.0	.....	288,600	10,380	.....	163,944
Pacific.....	.....	217,127	.....	1,711,000	12.6	30.0	.....	434,000	10,400	.....	218,714
Totals.....	4,208,251	1,265,760	.....	7,470,078	.....	.....	.....	1,087,800	297,410	1,221,520	3,295,264

(a) Loss.

growth of rural population, calls for little comment. As in the case of the urban total, I have made two estimates of the amount of natural increase, and of rural migration, for New England, based on the two different rates. The employment of the lesser rate in both urban and rural analysis gives fairly similar amounts of rural migration.

The sums expressing rural migration in Tables V and VI for the several divisions should, of course, be identical. In some cases they are very wide apart. I have worked out rural migration on the basis of several different kinds of modifications of certain factors. Thus I distributed emigration differently, assigning a greater share to certain divisions, and to the urban or to the rural in given divisions, than in the tables. I also tried interdivisional migration of native born according to the untreated census figures and according to the different rates of natural increase and of death. But the present plan has more nearly reconciled the two series of amounts of rural migration.

Column 6 of Table VI is especially interesting. It is observed that in three divisions the natural increase amounts to several times the actual division increase, that in others it is equal to or greater, and that in two the Census expresses a deficit, in one of which cases the amount of natural increase is over one million. This situation, of course, signifies that the other sources of population have been supplanting individuals born in the division or that the latter have gone to other divisions.

A comparison of the totals of Table VI with similar amounts previously estimated, as in the case of the figures in Table III, shows these differences: For immigration, 15,000; natural increase, 168,000; emigration, 3,000; incorporation, 4,500; rural migration, 304,000. The total for rural migration differs by 100,000 to 150,000 from those given in Table V, column 15. The division losses and gains also show a variation in totals of about 135,000. In a field of such extreme complexity, however, and where there is no known means of eliminating assumptions, the occurrence of divergences would be anticipated by the statistician.

A comparison of the estimates of rural migration and of interdivision migration of native born secured by the two sets of analyses which were made, the one rural and the other urban, is of assistance in explaining how the apportionment of the results of migration of native born between urban and rural communities may produce great fluctuations. For this purpose it is useful to draw those data together in a table.

TABLE VII.

RURAL AND URBAN AMOUNTS OF RURAL MIGRATION AND INTERDIVISION MIGRATION OF NATIVE BORN, BY DIVISIONS.

Division.	Rural Migration.		Interdivision Migration Native Born.			
	By Rural Analysis.	By Urban Analysis.	By Rural Analysis.		By Urban Analysis.	
			Loss.	Gain.	Loss.	Gain.
	44,628	62,200	.....	.....	.....	.....
New England.....	24,448	(a) 53,800	1,840	.....	18,160	.....
Middle Atlantic.....	417,634	314,579	4,380	.....	10,620	.....
East North Central.....	797,378	857,100	326,000	.....	362,000	.....
West North Central.....	602,454	532,252	439,000	.....	221,500	.....
South Atlantic.....	456,010	572,161	76,900	.....	27,100	.....
East South Central.....	363,696	382,053	373,400	.....	83,600	.....
West South Central.....	228,808	519,809	.....	265,200	.....	104,800
Mountain.....	165,944	53,218	.....	288,600	.....	162,200
Pacific.....	218,714	174,900	.....	434,000	.....	572,000
Total.....	3,295,264 or 3,275,086	3,468,272 or 3,405,472	1,087,000	1,121,520	839,000	722,000

(a) Deficit.

An inspection of the data in Table VII is sufficient to indicate that the differences between the amounts of rural migration in the first two columns might readily be accounted for on the supposition that the effects of interdivision migration of native born are not truly apportioned between rural and urban communities. Thus, in the West South Central division, the gains, rural and urban, if differently distributed between those districts, could easily reconcile the differences in the amount of rural migration given by rural and urban analysis. In the first two divisions, this is not so true. But a different apportionment of emigration losses would be sufficient to reconcile the divergencies there. These estimates must remain far apart, however, until some method has been

found to apportion the results of emigration and migration of native born according to the actual events. Meanwhile it will be best to state the amount of rural migration occurring in the different divisions in terms of the minimum and maximum furnished in columns one and two of Table VII.

Relative to the rural migration of the nation as a whole, we have found a range of estimates from 3,275,000 (Table VII, column 1), which was the lowest estimate given by rural division analysis, to 3,637,000 (Table II), the maximum, given by the analysis of the whole urban population of the nation. This is a range of 362,000, or about 10 per cent. of the maximum estimate. Perhaps the true estimate, if known, would fall somewhere between the two, approximating 3,500,000.